EPA Region 1 RAC 2 Contract No. EP-S1-06-03

May 16, 2018
Nobis Project No. 80021
MA-4426-2018-F

Via Electronic Submittal

U.S. Environmental Protection Agency, Region 1
Attention: Mr. James DiLorenzo, Task Order Project Officer
5 Post Office Square, Suite 100
Boston, Massachusetts 02109-3919

Subject: Technical Review Memorandum – Draft Final Remedial Investigation, Operable Unit 3
Olin Chemical Superfund Site, Wilmington, Massachusetts
Task Order No. 0021-RS-BD-01CH

Dear Mr. DiLorenzo:

As requested, Nobis Engineering, Inc. (Nobis) has prepared this Technical Review Memorandum regarding the "*Draft Final Remedial Investigation, Operable Unit 3",* prepared by Amec Foster Wheeler Environment & Infrastructure, Inc., on behalf of the Olin Corporation for the Olin Chemical Superfund Site in Wilmington, Massachusetts.

Should you have any questions or comments, please contact me at (978) 703-6038, or jbrunelle@nobiseng.com.

Sincerely,

NOBIS ENGINEERING, INC.

Jeff Brunelle
Project Manager

Attachment

c: File 80021/MA

COMMENTS GENERATED FROM REVIEW OF
DRAFT REMEDIAL INVESTIGATION REPORT, OPERABLE UNIT 3
OLIN CHEMICAL SUPERFUND SITE
WILMINGTON, MASSACHUSETTS

Nobis Engineering, Inc., on behalf of the U.S. Environmental Protection Agency (EPA), has reviewed and generated the following comments on the "*Draft Final Remedial Investigation, Operable Unit 3",* prepared by Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec), on behalf of the Olin Corporation (Olin) for the Olin Chemical Superfund Site (Site) in Wilmington, Massachusetts.

1.0 MAJOR COMMENTS

Major comments on the document are provided by subject in the following subsections.

1.1 Overall Document

1. Several documents cited (such as the MACTEC Focused Remedial Investigation [MACTEC, 2007]) are not included in the reference list. Please reference all cited documents in Section 8.0.
2. The RI report is intended to be a standalone document. Data used to support the evaluations and conclusions must be included in the report itself (the reader should not rely on references to previous/other report submissions for supporting data).
3. Report text describes conclusions without referring to evidence (chemical, physical or otherwise) or technical explanations to support those conclusions. In several instances, the FS (AMEC, 2018) provides more detail and technical justification. Where the FS discussion is more complete, we have referred to those sections for inclusion into the RI text.
4. Report sections appear to be contradictory or repeated in separate areas (e.g. both Section 4.2 and 5.1 describe contaminant sources and present data in slightly different ways, leaving the reader to attempt to parse out the most accurate and complete version).

1.2 Report Objectives

The overall objective of the RI report is to define the sources, nature and extent of contamination, transport mechanisms, and ultimate potential fate of contamination. Section 1.1 includes several bullets of RI report objectives which are prescriptive and do not adequately describe the need for evaluation, as indicated in the following comments.

1. Section 1.1, 3rd bullet, indicates that one objective of the OU3 Report is to assess surface water and groundwater interactions by measuring the gradients. The assessment of surface water and groundwater interactions should not be limited to gradient measurements. Recommend deleting the phrase "by measuring the gradient between shallow groundwater and surface water at specific locations." Additional potential evaluations include comparison of contaminant and groundwater chemistry and identification of potential confining units such as fine-grained sediment.
2. Section 1.1, 4th bullet, indicates that the objective of the bedrock evaluation in the OU3 report is to assess groundwater quality surrounding the DAPL pools near Eames Street, Main Street, Jewel Drive, and Cook Avenue. The bedrock evaluation should include all areas where bedrock contamination may be reasonably suspected, which includes any areas of known bedrock contamination, bedrock located beneath elevated concentrations in the deep overburden, and areas downgradient of or along fracture sets emanating from known areas of bedrock contamination.

1.3 Geology/Hydrogeology

1. The OU3 boundary should be expanded based on recent detections of NDMA to the north of the Olin property. Section 1.0, 2nd paragraph defines OU3 as "all on-Property and off-Property groundwater areas including Maple Meadow Brook Aquifer (MMB aquifer), groundwater beneath the Olin Property, and groundwater located south and east of the Olin Property". This text is the same as in the Final 2009 RI/FS Work Plan (Mactec, 2009). Please change the definition of OU3 to incorporate all areas where groundwater contamination from the Olin property has come to be located, or at the least, changing this text to "located south, *north*, and east…"
2. Appendix A should include all available boring logs and well construction logs, not just the logs created during the RI field investigations. The RI should be a complete record of the Site and the reader should not be required to locate this information in other reports. Appendix A

would therefore be referenced instead of the “previous reports” mentioned in Section 2.1.2.10 and in other sections as needed.

3. Appendix D should include all available borehole geophysics results available, not just those from the RI field investigations. See comment 2 above.
4. Figures 2.1-1 and 2.1-2, 2.2-1 through 2.2-6, 2.2-10, 3.3-1 and 3.3-2, 3.6-1, and all Section 4 figures contain a thick purple line depicting the Ipswich and Aberjona watershed boundary. Is the source of this boundary the MassDEP watershed delineation, or is it based on Olin’s RI work? The figure legends should be updated with the source information.
5. Synoptic water level rounds: Wells have been installed after the 2011 synoptic water level rounds were completed. The additional bedrock wells and wells installed outside of the Olin property have the potential to provide new insight into groundwater flow and contaminant migration. Some limited water level rounds have been conducted since 2011, and these results should be discussed and figures included in the report.. In addition, a future synoptic water level round (as described in the 3rd paragraph of Section 2.2.3) should be planned to incorporate as many monitoring wells, piezometers, and surface water points as possible to provide a complete evaluation of groundwater contours. This may be performed as part of remedial activities.
6. Please include a well construction table including all monitoring wells and multi-level ports in the RI. This information has been provided in the past, but has not been provided in an updated form to include all wells installed to date. This information is critical to evaluate subsurface data.
7. Section 3.2.1, 2nd paragraph states that discussion of the shallow overburden materials (concrete slabs, fill, organic/peat deposits) have been omitted because they have no bearing on OU3. This is incorrect. The extent and rate of recharge to the subsurface (and therefore both groundwater and contamination flow) is controlled by the relative permeability of the shallow overburden materials. In addition, near surface organic deposits may serve as important sinks for contamination that may be carried downward with recharge from precipitation. Please add discussion of the shallow overburden materials and describe how they may inhibit or enhance recharge and therefore groundwater flow patterns.
8. EPA had requested a north-south cross-section running north-south to evaluate potential source areas. The cross-section provided is focused on the immediate vicinity of the former Lake Poly and reproduces a figure originally provided in the OU1/OU2 RI (Figure 3.2-2). We were particularly interested in the soils, bedrock, and potential groundwater pathways from the Lake Poly source area to the DAPL pools. The other cross-section lines provided are

perpendicular and significantly west of this area. Please add the following to evaluate the groundwater conditions associated with the original source area and to evaluate groundwater conditions in the areas of high NDMA concentrations north and southeast of the Olin property (see attached mark-up):

a. Extend cross-section A-A’ to the north to incorporate data from the GW-400 cluster.
b. Extend cross-section A-A’ to the southeast to incorporate the upper DAPL pools and the following wells (in order from the current southern end of the cross-section): GW-76S, GW-CA1/GW-CA2/GW-36, MP-1, GW-79S/PZ-16RR, PZ-18, GW-50S/D, and GW-49D/GW-80BR/D/S
c. Extend cross-section B-B’ to the east to incorporate data from the GW-413 cluster.
d. Extend the Lake Poly cross-section to the north to incorporate data from GW-302, GW-301, GW-31S/D, the GW-413 cluster, and GW-415D (from south to north). If a borehole is installed to the west of the GW-413 cluster, this may replace that cluster.
e. Extend the Lake Poly cross-section to the south to incorporate DAPL pool information, including the following (from north to south): GW-35S/D, GW-30DR/PW-2, GW-202S/D/BRS/BRD, and GW-39

9. Section 3.2.3: Please add and appropriately reference a figure depicting Olin’s understanding of the bedrock lithology and regional fault structures. Figure 3.2-1 of the FRI (MACTEC, 2007) (updated to include observations from more recent borehole geophysics work) may be used.
10. The bedrock topography is a critical evaluation in terms of DAPL migration and groundwater contamination. Please add another subsection to Section 3.2.3 that focuses on bedrock topography. This subsection should include:
    a. discussion in Section 3.2.3, last two paragraphs;
    b. discussion of the additional cross-sections discussed in the previous comment; and
    c. an evaluation of the competence of the bedrock surface in general and specifically in the areas where DAPL has been identified. Note that borehole geophysics frequently begins below a casing which has been grouted into rock; therefore, boring logs and other indirect measurements of surface competence may need to be used for evaluation.
11. Section 3.3: Please calculate and tabulate groundwater flow rates based on representative hydraulic conductivities and gradients at multiple depths and in different areas of the Site, taking into account ranges of geologic material encountered, and add to the text or a table as appropriate. If site-specific hydraulic conductivities are not available, explain the reasoning for

selecting representative values. This information is critical to evaluate potential contaminant migration rates.

12. The discussion of bedrock hydrogeology (Section 3.4) should be expanded to include the following topics:
    a. Discussion of hydraulic conductivities measured in bedrock in different areas (not just a single borehole). Note that Table 3.3-2 lists hydraulic conductivity values for MW-202BR, MW-203BR, MW-204BR, and MW-206BR.
    b. Calculation of an estimated range of bulk (large-scale) groundwater flow rates based on gradients and hydraulic conductivities.
    c. Evaluation of the potential for fracture interconnection and groundwater transport. While bedrock groundwater flow is through individual fractures, several bedrock boreholes have extremely large fractures and fractured zones. Can these significantly fractured zones be treated as analogous to a porous medium?
    d. Presence and thickness of a weathered bedrock zone at the top of bedrock.
    e. The elevation differences between bedrock boreholes do not suggest that groundwater will necessarily flow from high to low head, because bedrock groundwater flow is generally restricted to fractures. However, they do indicate potential for groundwater flow, and on a sufficiently large scale, may be appropriate to indicate groundwater flow. Please prepare bedrock groundwater contour maps and discuss potential for bedrock groundwater flow, and how the fracture regime may facilitate (or not) this potential for flow.
    f. Evaluate the potential for groundwater flow in bedrock near the bedrock DAPL pools and other areas of DAPL.
    g. Section 5.2, 1st paragraph suggests that bedrock flow directions mimic deep overburden groundwater flow because the two systems are connected. With competent bedrock, the systems may not be connected to a significant degree. The discussion of bedrock flow should address the potential connection between aquifers.
    h. Please discuss the expected fracture regime in the vicinity of Cook Ave, and describe both the quantity and quality of hydrogeologic data available to determine the potential bedrock migration pathways in this area.
13. Section 3.5, Maple Meadow Brook and Sawmill Brook: The MMBW may not have significant surface water impacts directly attributable at the Site at this time (although NDMA has been detected at very low concentrations there); however, surface water at the MMBW is a potential target of contamination from shallow surface water. While most of the shallow groundwater

samples at the MMBW have been non-detect for NDMA, elevated concentrations of NDMA in shallow groundwater have been detected at GW-83S, GW-82S, and potentially upgradient (GW-58S). The limited NDMA data from GW-83S also indicates that concentrations have increased over time. This shallow groundwater has the potential to migrate upward and impact the MMBW, and therefore the surface water bodies associated with it. Please add a complete discussion of Maple Meadow Brook and Sawmill Brook surface water to the report.

14. Section 3.6 describes a comparison of water level maps without providing the original maps (Smith, 1997, plates 2-3 and 2-5) for comparison or describing how they differ. Please provide a copy of the water level maps reviewed and show Olin's interpreted water level divide, as neither figure in the Smith Report depicts the groundwater divide. Please also provide discussion of where the contours differ and implications for groundwater flow directions, and of potential differences in gradients.
15. Section 5.4, DAPL Pools, 6th paragraph (page 5-4): The discussion of effects of pumping of town wells should include the data described in the previous comment. Please refer to a comprehensive discussion of groundwater flow under pumping and non-pumping conditions in Section 3.6.

1.4 Groundwater Use and Value/Screening Levels

1. Section 3.7: MassDEP has prepared a Groundwater Use and Value Determination (MassDEP, 2010) that supports a high use and value determination for the Site area aquifer. Please include discussion of the Groundwater Use and Value Determination in this section. Because of the high use and value determination, the existence of active private supply wells, and the lack of a legally-enforceable prohibition on installation of new wells, the portion of the Aberjona watershed within the OU3 study area should be considered a potential drinking water source.
2. Section 4.1 repeats the same information as Section 3.7 and the same issue applies to the previous comment.
3. The Section 4 chemistry figures (Figures 4.4-X) should include an area of impact/plume outline based on the MCL, RSL, or other agreed-upon screening level for potential groundwater use.

1.5 Contamination

1. Section 1.4.2.4 should have a more complete discussion of the sewer and septic systems, as leaking piping may have been a significant source of contamination in addition to the various disposal lagoons and pits. The section refers to more detailed discussion from the OU1/OU2 RI (Amec Foster Wheeler, 2015b), but the details specifically pertinent to potential groundwater sources should be brought forward to the discussion. These include piping schematics, description of piping construction (to the extent known), and a reference to a figure showing these features. Known or suspected leaks in process sewer lines (described in the last sentence of Section 1.4.2.3, 5th paragraph) should also be included in this discussion.
2. Olin has identified the Lake poly area as a potential original source of DAPL. The groundwater investigations originally performed in this area (Section 2.1.2.3) encountered relatively high NDMA concentrations in deep overburden, which have remained above screening criteria based on RI (later) data. The closest bedrock wells to this area are the GW-406 cluster (to the north and upgradient) and BR-1/the GW-202BR cluster (likely impacted by ongoing impacts close to the slurry wall). Bedrock groundwater in this area appears to be a data gap. Please provide an evaluation of the potential for groundwater contamination in bedrock in this area.
3. The data from the private water supply sampling should be included either as its own appendix or as part of Appendix E.
4. Section 4.2.1 states that the areas of groundwater impacts from OU1 soils are typically small and of limited extent. Please provide figures showing locations of these soil source areas so that they may be compared with groundwater concentrations, and discuss the potential for leaching and groundwater migration associated with each soil source area. Discussions of soil impacts on groundwater were deferred from the OU1/OU2 RI (AMEC, 2015, Section 5.2, 1st paragraph on page 5-6), and require full evaluation in this report.
5. Section 4.3.2 should provide the final list of contaminants of interest for discussion of contaminant nature and extent. This section should also describe the selection criteria for selecting contaminants of interest based on exceedances of screening criteria and frequency of detection. While Section 4.3.2 does describe fuel related compounds and chlorinated solvents as being related to other properties, it does not list the specific compounds that are screened out based on this evaluation. For comparison, we have highlighted potential contaminants of interest based on frequency of detection and exceedances of MCLs/SMCLs

or residential tapwater RSLs if MCL/SMCLs were not available. See attached table. Please revise the text accordingly.

6. Section 4.4 describes contaminant distribution for a number of representative contaminants of interest. In addition to these contaminants, dibenz(a,h)anthracene exceeds the tapwater RSL in more than 5% of samples analyzed. PAHs have also been identified at concentrations above background in OU1 soils. Please add contaminant distribution maps for PAHs (or a single representative PAH) and add a discussion of their distribution.
7. The data depictions in the Section 4.4 contaminant maps are based on a statistical comparison to the results for each figure. Therefore, it is difficult to compare figures for different depths for the same contaminant. For example, the maximum sulfate concentration in deep overburden is almost an order of magnitude above that of bedrock and the TMP1P maximum concentration in shallow overburden is more than an order of magnitude above that of bedrock. Please use the same symbol weighting for all three depths for a given contaminant to facilitate comparison.
8. Section 4.4.5: Please note that even though a particular metal is naturally present in an aquifer matrix, if other contamination or Olin's actions caused a geochemical change allowing for increased dissolution in groundwater, Olin is still responsible for and must address the ensuing elevated metals in groundwater.
9. Section 4.4.5.3: The text states that hexavalent chromium was detected inconsistently and that these concentrations are considered to be false positives. However, the hexavalent chromium is consistently encountered along the western Olin property boundary and the northern portion of the property in shallow overburden groundwater (potentially oxygenated) and in bedrock groundwater south and southwest of the containment cell. In addition, hexavalent chromium was detected and exceeded its tapwater RSL in approximately 10% of the samples collected. Given that these detections do not appear to be random, hexavalent chromium should be carried forward in the discussion of potential groundwater contaminants.
10. Section 5.1: In addition to individual sources, please describe areas of groundwater impacts and indicate these areas on figures as needed. The areas of groundwater impacts may coincide with known source areas or may not, but these areas should be described and potential sources identified.
11. Section 5.1, 1st paragraph: The second sentence states that DAPL pools are not groundwater. This is incorrect. DAPL is a term that Olin has used to describe groundwater that has sufficient dissolved solutes that it is heavier than pure water and behaves similarly to a brine. However,

it is still in the aqueous phase in the subsurface, is not present as a separate phase (is entirely miscible) and is therefore groundwater.

12. Section 5.1, 1st paragraph: groundwater at the Site is not necessarily in chemical equilibrium with the saturated soil. While contamination in the soil may be present for decades, the movement of groundwater allows for fresh water to continually contact this contamination. Depending on the rate of groundwater flow and the reaction kinetics of the sorbed contamination, the water may or may not be in chemical equilibrium with the aquifer matrix. Please revise the text.
13. Section 5.2.1, 3rd paragraph states that the on-property DAPL pool is no longer considered to be a source of dissolved constituents to overburden groundwater. NDMA concentrations at the GW-202 cluster, downgradient of the slurry wall, remain elevated from shallow overburden to deep bedrock. This suggests that either the slurry wall is not sufficiently protective (Olin considers the slurry wall to be a sufficient barrier and that the bedrock in the area is entirely competent, and therefore that this is not the source) or that significant residual contamination remains in the subsurface south of the containment cell. It is not clear that the ongoing contamination is entirely from the Main Street DAPL plume. Therefore, the on-property DAPL pool should be discussed specifically as its own potential source.
14. Section 5.2.2, 1st and 2nd paragraph: Figure 4.4.1-1a clearly shows a plume of NDMA in shallow groundwater beneath MMBW, extending from GW-82S to MP-5 to GW-65S. These locations also have relatively high chloride concentrations and sodium concentrations relative to other monitoring wells in the MMBW. Note that Kempore and hydrazine have been detected in MMBW surface water. Therefore, the MMBW may be potentially impacted by contaminated shallow groundwater. Please revise the text accordingly.
15. Please revisit/validate specific gravity and chemistry statistics used to determine the definitions of DAPL and diffuse groundwater based on the updated samples from the RI. Now that it has been more than 20 years from the initial evaluation and Olin has a substantial new data set, the original assumptions should be validated to ensure that they are still correct.

1.6 Conceptual Site Model/Fate and Transport

1. Slurry wall and equalization window: Section 1.3.2, 4th paragraph (page 1-8) and Section 2.1.1.1, 4th paragraph (page 2-4) describe the slurry wall equalization window, which allows free movement of shallow groundwater in and out of the structure. Given that waste was retained in place for slurry wall construction and that a DAPL pool is present in this area, it is

likely that contamination will diffuse upward and re-contaminate the shallow groundwater that passes into and out of the equalization window. Please discuss potential mass flux from the equalization window. Note that this mass flux was calculated within the “Semi-Annual Analysis of Post-Construction Monitoring Plan Data” report included as an appendix to the Construction RAM status report 8 (GEI, 2004).

2. Source of dissolved phase contaminants in groundwater: Section 1.3.7, 6th paragraph (page 1-11): The text states “The majority of existing dissolved phase contaminants in groundwater resulted from convective mixing during initial migration of the DAPL while the facility was being operated. The mass flux of dissolved constituents through the diffuse layer is likely small in comparison to those initial releases from convective mixing.” This assertion is not supported by any data in this section and should be evaluated in the discussion of fate and transport. Please omit from this section.
3. Section 5.2.2, 5th paragraph: The groundwater modeling shows significant concentrations of NDMA in bedrock close to the DAPL pool, and that the concentrations in bedrock in this area will remain high even upon DAPL pool removal from the overburden (and presumably, the nearest bedrock fractures). The distance of bedrock migration is relatively short (appears to be less than 200 feet). The figures provided in Appendix H appear to show relatively low overburden concentrations downgradient of the DAPL pool. The Wilmington water supply wells are in overburden groundwater and more than 2,000 feet from the Main Street DAPL pools (1,300 feet from GW-83D). Removal of the primary contaminant mass may thus enable reduction of downgradient concentrations even if the bedrock cannot be remediated (an assumption that we do not agree with), setting aside issues of potential exposure to DAPL remaining in readily-accessible areas in the overburden.
4. Section 5.2.2, 6th paragraph: Olin contends that the overburden and bedrock aquifers are connected and that pumping the overburden aquifer would depress the bedrock aquifer and therefore pull contaminants from the bedrock to the overburden.
    a. Given the thickness and apparent high conductivity of the overburden aquifer in the vicinity of the MMBW, and the lack of definitive connection between the bedrock and overburden in this area, Olin’s conclusion is premature. Olin has not provided a rigorous evaluation of pumping vs. non-pumping conditions on the overburden and bedrock aquifer. A pumping test or series of pumping tests would help to evaluate the extent to which overburden pumping would pull in bedrock groundwater. In lieu of this data, which can be collected during a later investigation, Olin should include a comparison of hydraulic data collected before and after pumping cessation.

   b. Olin provides additional support for the potential connection between bedrock and overburden groundwater during pumping in Section 1.4.2 of the FS (AMEC, 2018), describing trends in GW-103D. We looked at trends for the parameters described in the FS in the wells closest to the Chestnut Street pumping wells (GW-103 cluster and GW-63 cluster), as well as the wells closest to the next-closest pumping wells (GW-64 cluster and GW-86 cluster) and did not see a consistent trend for all these parameters. Please provide trend charts and a full evaluation of these trends to support the potential for overburden-bedrock connection.
5. Section 5.2.3, Ipswich watershed: Additional routes of migration include the following, which should be added to the text:
   a. Shallow groundwater migration from the central portion of the MMBW to surface water.
   b. Interception of low concentrations of contamination by private well pumping, causing sporadic NDMA detections.
6. Section 5.2.3, Aberjona watershed: Additional routes of migration include the following, which should be added to the text:
   a. Migration of dissolved constituents from the area south of the containment area in deep overburden and bedrock off-site to the southeast.
   b. Migration of dissolved constituents in bedrock from the DAPL pools to the south, where they may be intercepted by private drinking water wells.
7. Section 5.3: Please include leaching of contaminants from soil as a potential transport mechanism in groundwater.
8. Section 5: The discussion of DAPL and groundwater interaction in the FS (AMEC, 2018, Section 1.4.4) has more details regarding bedrock and DAPL migration than Section 5.2. Please revisit and add these details (degree of weathering and location of weathered zones, migration of DAPL, and migration of diffuse groundwater).

2.0 MINOR COMMENTS

Minor comments are listed by report section below.

2.1 Section 1

1. Section 1.1, 2nd bullet states that a report objective is to determine *current* groundwater flow directions and gradients. The RI does include some evaluation of the previous (pumping) flow regime, so the reference to current groundwater should be omitted.

2. Section 1.2, first sentence: The text should be revised to state that the OCSS includes the areas described *in addition to* wherever contamination from Property manufacturing and waste disposal practices has come to be located.
3. Section 1.2, second paragraph, second sentence: The text refers to process waters and wastes that were discharged to unlined excavations. These locations should be described (e.g. the former Lake Poly and others) and a reference to these locations on a figure (such as Figure 1.3-2) should be added.
4. Section 1.2, third paragraph (page 1-4): Please spell out which chemical manufacturing buildings are referred to, and add a reference to a figure. Figure 1.3-2 shows the various buildings associated with Olin operations, but does not refer to a group of chemical manufacturing buildings per se.
5. Section 1.3, third paragraph, second sentence (page 1-6): The statement refers to an Environmental and Open Space Restriction "described above", but the restriction is not mentioned before the statement. Please add a reference to (can be to a later section) or discussion of this restriction.
6. Section 1.3, fifth paragraph (page 1-6): Please provide a reference to a figure depicting the on-property and off-property water bodies described, such as Figure 1.3-1.
7. Section 1.3.2, third paragraph, last sentence (page 1-8): Section 2.1.2.2.2 of the FRI (MACTEC, 2008) does not have any additional information not included in this section; recommend omitting this reference and retaining only the reference to the original C-RAM status report (GEI, 2004).
8. Section 1.3: Recommend changing order of subsections so that off-property surface water (currently Section 1.3.6) is described immediately after on-property surface water (Section 1.3.3).
9. Section 1.3.4: Please show the 20 acres of the Environmental and Open Space Restriction on a figure and refer to it in this subsection.
10. Section 1.3.6: The East Ditch (both the upper and lower sections) should be added to this subsection. These ditches may be an important component to evaluate contaminant fate and transport in shallow groundwater north of the Olin property where the NDMA plume was encountered.
11. Section 1.3.7, 2nd paragraph: Please refer to a figure that shows both the DAPL pools and their names as provided in the text, such as Figure 1.3-4. Figure 1.3-4 does not include an "Upper DAPL Pool." If this feature is used to describe the combined Off-Property and On-Property DAPL pools, it should also be shown on a figure. If this term is used solely as a

descriptor to describe the DAPL pools that are higher in elevation, recommend not capitalizing "Upper" and making it clear at the beginning of the second paragraph that the upper DAPL pool includes two pools.

12. Section 1.3.7 5th paragraph (page 1-11): The text states that "The 20,600 μmhos/cm value was statistically derived by previous investigators as a threshold value…" Please provide a reference to the specific document that developed the DAPL threshold concentrations.
13. Section 1.3.8: Please add a reference to a figure showing the watershed divides.
14. Section 1.4.2.2, 3rd paragraph: Is the Tank 7 of the Plant B treatment system the same as the Tank 7 that was part of the Plant B Tank Farm? If so, can these identifiers be modified for clarity?
15. Section 1.4.2.3, 3rd paragraph (page 1-16): Lake Poly has been identified as a primary source area and is of interest for the RI. The text notes that Lake Poly has been the subject of several investigations, as documented in the FRI (MACTEC, 2007), the OU1/OU2 RI (AMEC Foster Wheeler, 2015b), and in several MassDEP submittals. Please provide references to the primary MassDEP submittals where this information can be found.
16. Section 1.4.2.4 states that additional description of the sanitary and septic systems at the facility are provided in the FRI (MACTEC, 2007) and the final OU1/OU2 RI Report (Amec Foster Wheeler, 2015b). Upon review of these files, the descriptions of these systems are essentially the same. We recommend only using one reference (such as the OU1/OU2 RI report) for clarity.

2.2 Section 2

1. The last paragraph of the introduction to Section 2 refers to the FRI (MACTEC, 2007) for a list of previous investigations conducted through 2006, supplemented by the RI Work Plan (MACTEC, 2009) and OU3 Data Gap Work Plan (AMEC Foster Wheeler, 2015a). Given the large number of investigations conducted at the Site, it is not reasonable to require the reader to back-track through these documents for a list of previous investigations. Please include a table of investigations relevant to OU3, investigation dates, and references to reports if available.
2. Section 2.1.1.1, 7th paragraph (page 2-4) and Section 2.2.5, 1st paragraph: EPA did not specifically request hydraulic pulse interference testing (HPIT) to assess integrity of the slurry wall. Rather, EPA suggested that Olin may consider methods such as HPIT to help support

Olin's contention that the slurry wall was in good condition and continued to provide hydraulic control. Please revise the text accordingly.

3. Section 2.1.2: Please add a reference to the results (or the most recent report for on-going monitoring) for each of the groundwater monitoring and investigation programs listed.
4. Section 2.1.2.1: Please list other analyte groups analyzed for under the town and sentinel monitoring program (more specific than "some other water quality parameters").
5. Section 2.1.2.2, 3rd paragraph (page 2-8): Please provide a reference for the specific IRA Status Report(s) that would be appropriate for the reader to use to evaluate "details of the sampling and analysis". If the NDMA IRA final completion report would be the appropriate document, please include a specific reference to that report in the text and in Section 9.
6. Section 2.1.2.3, 3rd paragraph: The section concludes that neither DAPL nor potential NDMA precursors were present at the former Lake Poly and that this feature is no longer an ongoing source of DAPL. Please add "in overburden groundwater" to these conclusions.
7. Section 2.1.2.4: Please confirm the reference to "MACTEC, 2004". The only reference in Section 9 that appears to match this is a field report for Lake Poly. The reference in the text of the FRI is also unclear, but this appears to be the reference indicated as "MACTEC, 2004i" in Section 8.0 of the FRI.
8. Section 2.1.2.5: Please add a reference to the most recent PCMP status report.
9. Section 2.1.2.8, 3rd paragraph: The last sentence indicates that locations close to the crest of the bedrock saddle had "diluted" concentrations of DAPL constituents, while samples from outside the reservoir had "ambient" groundwater conditions. Are the "diluted" concentrations the same as "diffuse" groundwater, and what range of concentrations was detected in the "ambient" groundwater? Please be consistent with terminology.
10. Section 2.2 introduction: why does bullet 2 say that USEPA will assess risks to human health and the environment, and not Olin?
11. Section 2.2.1, 10th bullet (page 2-18): please include the DAPL multi-port monitoring wells MP-1, MP-2 and induction logging wells ML-1 and ML-2 on Figure 2.2-1, or include a separate figure depicting the wells associated with the DAPL pilot test.
12. Section 2.2.1, 11th bullet: please include the HPIT monitoring wells GW-409, GW-410, GW-411, and GW-412 on Figure 2.2-1
13. Section 2.2.1, 5th and 6th paragraphs (page 2-18): recommend adding a reference to the appropriate part of Section 3, where these borehole geophysics results should be integrated with previous work to update the geology/hydrogeology CSM.

14. Section 2.2.4, 1st paragraph: Please include a reference to the final reports for the DAPL extraction pilot test here and in Section 8.0.
15. Section 2.2.7, 2nd paragraph (page 2-24): Please include the private well data in this report. Generic statements such as the last sentence in this section ("All data generated by subsequent sampling of private wells has been submitted to USEPA under separate cover.") are not acceptable.
16. Section 2.2.9: Please provide a figure that shows the sample locations used for the vapor intrusion assessment, and list the samples/wells used in this assessment in a table.
17. Section 2.2.10: Please add discussion to this section regarding any changes from what was outlined in the data gaps work plan (Amec Foster Wheeler, 2015a).

2.3 Section 3

1. Section 3.1, last paragraph (page 3-2) states that the wetland boundary was delineated as described in the RI/FS work plan (MACTEC, 2009). The only description of the wetland in this document is Table 3.2-1, which describes the BSC revision of the delineation (September 2004) but does not provide any further description. Please provide a description of the wetlands based on a primary source (assumed to be the BSC revised delineation) and an assessment of the appropriateness of this delineation, given that it is more than 13 years old. Have any development, significant flooding, or other potential impacts changed the wetland?
2. Section 3.1.1, 1st paragraph describes the Ipswich and Aberjona watersheds, but the figure reference (3.1-2) describes drainage basins, which do not necessarily have the same name. Please specify how the drainage basins relate to the watersheds.
3. Section 3.1.1, last sentence (page 3-2) states that floodplains are included on Figure 3.1-1. This figure does not depict any floodplains. Please add to this or add another figure depicting the floodplains, including the 10-year, 100-year, and 500-year, if applicable. Note that the Smith report refers to a 1993 CRA report for a discussion of the floodplains, and that this description is therefore more than 25 years old. Please use an updated reference when discussing floodplains.
4. Section 3.1.1: Please add a description of the floodplains and potential flooding impacts on Site areas. We recommend creating a separate subsection for the floodplain discussion.

5. Please incorporate additional cross-sections requested in major geology/hydrogeology comment 9 into the discussions of geology in Section 3.2.
6. Section 3.2.3.1: Please add discussion of the bedrock fracturing north of the Olin property (GW-413 and GW-415) and southeast of the Olin property, as the bedrock in this area is below elevated deep overburden NDMA concentrations. Note that the geophysical log for GW-413 indicates a number of large, relatively shallow fractures and that GW-415 appears to have an extremely large open fracture. Also include evaluation of geophysical results from boreholes with significant fractures from previous investigations (Smith, 1997 and Geomega, 2001)
7. Section 3.2.3.1: Please discuss the extent of weathering in bedrock with respect to lithology. Section 1.4.4 of the FS has a more extensive discussion of this issue that can be added.
8. Section 3.2.3.2: Please add discussion of the bedrock boreholes north of the Olin property (GW-413 and GW-415) and southeast of the Olin property (GW-80 BR).
9. Section 3.2.3.2: Please organize the discussion of individual bedrock boreholes in alphanumeric order.
10. Section 3.2.3.2: Please refer to Figure 3.4-1 and discuss in this section. Figure 3.4-1 suggests a common trend for major fractures that is not limited to the mapped Bloody Bluff Fault.
11. Section 3.2.3.2, 1st paragraph: please clarify “large vertical bedrock boreholes” in the text. Does this mean that a cutoff of open borehole length was used for discussion, and if so, what was that cutoff? All boreholes with a reasonable amount of open borehole (at least 15 feet) should be included in this discussion.
12. Section 3.3, 2nd paragraph: The December 2015 groundwater elevation data was not as complete as the 2011 synoptic water level rounds in some respects, but did incorporate wells located farther from the Olin property, suggesting that groundwater contours developed from this round may help evaluate groundwater across a wider area. Please add figures showing the groundwater contours based on the 2015 measurements and discuss any deviations from the 2011 data.
13. Section 3.3 would benefit from being separated into subsections, such as groundwater contours and flow directions; vertical gradients; horizontal gradients (including within the containment cell); hydraulic conductivity and aquifer materials; groundwater flow rates; and groundwater/surface water interactions.

14. Section 3.3: Please add discussion of groundwater/surface water interactions at the other surface water bodies: the east ditch, the off-property west ditch, and the MMBW. If not included in previous synoptic water level rounds, these should be included in upcoming water level rounds as well.
15. Section 3.3: Please add a figure depicting vertical gradients across the site. This information is critical to help determine groundwater and contaminant flow directions in three dimensions.
16. Section 3.4: Hydraulic conductivities in bedrock have been measured from bedrock boreholes other than just GW-62BR. Please expand this range to incorporate the other data.
17. Section 3.5: Please provide more discussion of the South Ditch flow and potential impacts of shallow bedrock as described in Section 2.4.3, 2.4.4 and 3.5.1 of the Smith report (1997).
18. Section 3.8 (2nd and 3rd paragraphs): The meteorological references (CRA, 1993) are now 25 years old. Please update these paragraphs with revised long-term temperature ranges.
19. Section 3.9.2: Please add a figure showing current land use and zoning for the study area. Recommend using data from MassGIS (OLIVER).

2.4 Section 4

1. Section 4.2.1, 4th bullet: arsenic is naturally occurring; however, the elevated concentrations in groundwater in this area may be related to geochemical changes from the degradation of the process oil. Please add this information to the bullet.
2. Section 4.2.3, 3rd paragraph: While the OU1/OU2 report did discuss the efforts to determine the origin of the NDMA in groundwater, the NDMA is a significant concern specifically for groundwater. Please describe the investigations performed to evaluate NDMA formation and provide references to the original documents that described these investigations.
3. Section 4.3.1, 1st paragraph states that Table 4.3-1 compares analytical results to the MCL or RSL. Table 4.3-1 appears to show only MCL results. Please adjust either the table or the text appropriately.
4. Section 4.3.2, 2nd paragraph and Section 4.4.3.1 state that CVOCs have historically been ascribed to operations at the former Altron/Sanmina property and an unnamed property to the east of the Olin property. Please provide references to documents supporting this statement.

5. Section 4.4.1, shallow overburden groundwater (page 4-8), 4th bullet: the narrow band of NDMA detections in the MMBW has been well defined. However, the NDMA in shallow groundwater immediately north and northeast of the Olin property is not defined (does not have non-detect values outside of the detections). Please revise the text accordingly.
6. Section 4.4.2.1, deep overburden groundwater, 3rd bullet (page 4-12): the text states that the ammonia in the central and downstream portions of the WBV are bounded by GW-73D. However, ammonia concentrations were detected both east (GW-404M) and northeast GW-400D/M) of this well. Therefore, the plume does not appear to be bounded in this area. Please add a discussion of this potential data gap to the text.
7. Section 4.4.2.2, deep overburden groundwater, 2nd bullet (page 4-15): the multiport well screened in DAPL should be MP-3.
8. Section 4.4.2.2, deep overburden groundwater and Section 4.4.2.5, deep overburden groundwater: it is not clear that elevated chloride and sodium concentrations near roads and parking lots are from surface salt applications, as at several locations have higher concentrations in deep overburden (GW-43, GW-69, GW-408). Please add a discussion of gradients in Section 3 to evaluate the potential impact of surface application of road salt.
9. Section 4.2.2.2, deep overburden groundwater, 3rd and 4th bullets (page 4-16): GW-50D is included in the list of wells impacted by road salt in the 3rd bullet and impacted by contamination migration at depth in the 4th bullet. Given that concentrations are higher at depth in this area, it is more likely that road salt is not a significant factor.
10. Section 4.4.2.3: Unlike other parameters of interest, sulfate concentrations appear to be widespread across the central and southern portion of the Olin property and frequently higher than the SMCL of 250 mg/L. These concentrations are at least partially independent of the path of DAPL/NDMA contamination, suggesting a potentially different source (leaching from soil?). Please discuss this distribution and possible source.
11. Section 4.4.3.2, overburden groundwater: both TM1P and TM2P have two separate primary source areas: the northern corner of the Olin property, and close to the eastern side of the containment area/slurry wall. Please describe this distribution and potential sources.
12. Section 4.4.4.2, overburden groundwater: Contrary to the text, diphenyl ether was detected in deep overburden in the Ipswich watershed, generally in the DAPL areas and core of the downgradient plume (GW-70D, GW-44D, GW-58D, GW-82D, GW-84D, GW85D, GW80D, and GW87D, roughly from south to north). Diphenyl ether was also detected between the DAPL pools. Please add discussion of these deep overburden groundwater detections to the text.

13. Section 4.4.5: Please add a reference to Appendix F in the introduction to this section and refer to it as needed throughout the discussion.
14. Section 4.4.5 and Figures 4.4-6-X: are the values discussed total or dissolved metals values? Please specify in the text and figure legend.
15. Section 4.4.5.1: several locations (GW-14, GW-31S, GW-55S, GW-307, and GW-402D) have aluminum concentrations that are much higher than anticipated and not located close to DAPL pools. These concentrations also tend to be erratic. Please check the higher aluminum results against sample turbidity to determine if turbidity effects are an issue.
16. Section 4.4.5.2: please describe the cobalt concentrations exceeding RSLs in overburden groundwater (shallow and deep) and describe potential sources.
17. Section 4.4.5.2, shallow overburden: A comparison of cobalt, cadmium, and nickel figures indicates that all three metals have relatively high concentrations at the east-central portion of the Olin property and east across the railroad tracks (area roughly defined by GW-402D, GW-17s, and GW-4) that appear to be independent of the influence of DAPL. Please discuss these elevated concentrations.
18. Section 4.4.5.3, overburden groundwater: chromium in the Ipswich watershed was detected in several wells in addition to the wells specified in the text: GW-60D GW-86S, GW-400D/S, and GW-404S. Please add these to the text.
19. Section 4.4.6.2, bedrock groundwater: Kempore was detected at GW-80BR, southeast of the Olin property, while Opex was detected at GW-68BR and not GW-81BR Please revise the text.

2.5 Section 5

1. Section 5.1: Please show each contaminant source area on a figure. Please also provide a short description of each area or a reference to a section in the report that describes each area. For example, is the “drum storage area” the same as Drum Area A, Drum Area B, and the Buried Debris Area referred to in the FRI?
2. Section 5.1: Please add the former acid pits to and the CSL this section or provide an explanation why they were not considered to be sources.
3. Section 5.1, DAPL Pools, 1st paragraph: Please refer to a figure for the locations of the DAPL pools.
4. Figure 5.1 was not included in the electronic copy of the RI report. Please provide.

5. Section 5.1, DAPL Pools, 5th paragraph: Given the extensive fracturing near GW-83D and the MMBW, it is more likely that most of the DAPL mixed with surrounding groundwater via advection to lower concentrations, rather than being captured within bedrock.
6. Section 5.1, DAPL Pools, 7th paragraph (page 5-4): The discussion of groundwater flow and the MMBW is not included in Section 3 and should be added there.
7. Section 5.1, DAPL Pools, 8th paragraph (page 5-4): The bedrock competence near the DAPL pools needs additional discussion and presentation of geologic data, as described in previous comments. The discussion in this paragraph should refer to back to a complete discussion in Section 3.
8. Section 5.1, DAPL Pools, 10th paragraph (page 5-4): Please refer to a document which outlines the DAPL chemistry in detail, preferably a primary document.
9. Section 5.1, DAPL Pools, Page 5-5: Please provide more discussion of NDMA precursors and the investigations to evaluate these. Section 1.4.3, 3rd paragraph of the FS (AMEC, 2018) includes more details that should be incorporated into the RI text.
10. Section 5.1, Domestic Gray Water: The text suggests that domestic gray water may be a potential source of NDMA in residential areas. While this theoretically may be a factor, the point remains that the highest concentrations of NDMA are relatively close to the Olin property and that other compounds associated with Olin (such as Opex inGW-68BR) have also been detected close to those locations.
11. Section 5.1, Domestic Gray Water: Please add the more detailed text regarding this potential source from the FS, section 1.4.2, Residential Wells, page 1-11.
12. Section 5.1: The Calcium Sulfate Landfill (CSL) was included as a contaminant source in Section 4.2.4. Please discuss this potential source in terms of groundwater contamination.
13. Section 5.2.2, last paragraph: Please omit this paragraph regarding the technical feasibility of remediating the bedrock, as it is premature for this document. Technical feasibility should only be determined after a thorough evaluation of potential treatment technologies and is appropriately discussed in the FS.
14. Section 5.3: Please provide references for discussions of chemical interactions and degradation for each contaminant, and refer to Appendix F when appropriate.
15. Section 5.3.1.2, 2nd paragraph: Please note that chloride concentrations are generally higher in deeper overburden than in shallow overburden and in within the groundwater plume. While road salt is expected to contribute some amount of chloride, this contribution appears to be smaller than the chloride from Site contamination.

16. Section 5.3.3: Please add references to other reports that include attribution of VOCs to other sources, or references to earlier parts of the document where discussion of these sources are introduced.
17. Section 5.3.3: Please describe impacts of the smear zone and soil sources on TMP concentrations in groundwater. Note that the OU1/OU2 FS refers to a discussion of the smear zone and TMPs in this report that does not appear to exist.

2.6 Section 6

See HHRA review comments and revise this section as needed.

2.7 Section 7

1. Section 7.1, 1st bullet: We do not agree that the extent of groundwater impacts in the Aberjona watershed have been completely delineated. While shallow overburden groundwater does appear to be reasonably well-bounded, NDMA impacts in deep overburden (and to a lesser extent, bedrock) appear to continue to the southeast.
2. Section 7.1, 2nd bullet: We do not agree that the groundwater contamination outside of the Cook/Border Ave areas does not have the potential to impact future wells. Industrial and private wells are scattered throughout the area, and there are no statutory limitations on installing new wells either for drinking or for industrial use.
3. Section 7.1, 4th bullet: We have reservations regarding the competence of the bedrock beneath the on-property DAPL pool. If contamination is not exiting the pool via fractures, it is possible that a significant residual contaminant source remains in the soil south of the containment cell.
4. Section 7.1, Ipswich Watershed (page 7-3): Olin has not demonstrated that pumping overburden groundwater (if DAPL is removed from the overburden) will result in significant contaminant migration from bedrock given the large volume of overburden material and much higher hydraulic conductivity than bedrock. Olin has also not demonstrated that the residual NDMA currently in bedrock will migrate far enough to impact the Town wells if overburden contamination is removed.
5. Section 7.1, Ipswich Watershed: NDMA is also present in shallow overburden groundwater in the MMBW above the plume core, and therefore has the potential to impact surface water in this area. Therefore, the final bullet in this subsection should be removed.

6. Section 7.2: The OU2 FS should address potential impacts to the MMBW from the shallow overburden groundwater plume.
7. Section 7.2: The OU3 FS should address the following additional areas:
   a. contamination south of the containment cell and
   b. Contamination north of the Olin property (to be addressed when current fieldwork is complete)

2.8 Tables

1. Table 2.2-1: Specific gravity analyses appear to be limited to the MP-X locations, based on our database, and do not appear to be included in the "inorganics" list in this table. If that is the case, please add a column for specific gravity.
2. Table 3.3-3 should also include calculated horizontal gradients in deep overburden and bedrock, including gradients north of the Olin property (e.g. from GW-413D to GW-415D or points further north).
3. Table 3.3.-4 should also include vertical gradients from deep overburden to bedrock.
4. Table 4.3-1: please include a note explaining the highlighting on this table, or remove the highlights.
5. Table 4.3-1: the screening value for chromium is listed as 100 µg/L and the range of detections is up to 200,000 µg/L in Aberjona watershed overburden wells, but the number of detections exceeding the screening value is 0. Please check – this is likely a difference between total chromium and hexavalent chromium numbers.

2.9 Figures

1. The legend for Figure 1.3-3 describes units for the Boston Harbor Drainage Basin and the Ipswich Drainage Basin. Please add a reference to the Aberjona watershed, as that is the term that is used in the text.
2. Figure 1.3-1 indicates an irregular shape around the former lake poly. It is unclear whether the "Lake Poly Excavation" label is intended for this large shape or for the much smaller oval shape at the north end of Lake Poly. Please adjust the label so that it is clear and eliminate one of the shapes if it is not needed for the figure.
3. Figure 2.2-2 is called "OU3 Groundwater Sample Locations"; however, it shows several wells that are not included in Table 2.2-1 (e.g. LPB-X wells, E-10, W-10, PZ-X locations, GW-12, etc.). Section 2.2.2, 2nd paragraph states that it also depicts shallow and deep overburden and

bedrock monitoring wells, suggesting that Figure 2.2-2 actually shows all available monitoring wells, not the ones that were actually sampled. Please change the symbols, colors, or otherwise distinguish the wells that were sampled from wells that were not sampled in the OU3 investigations.

4. Figure 2.2-7 should also include additional items:
    a. The piping runs for the extraction system.
    b. The figure includes numbers that appear to be associated with bedrock contours, which should be shown.
    c. Initial (pre-test) DAPL extent
    d. Current DAPL extent
5. Figure 2.2-8: Please indicate which wells were used for each of the phases of HPIT (suggest as separate colors).
6. Figure 3.1-1: The first paragraph of Section 3.1 states that this figure shows the surface water bodies in addition to topography. Surface water bodies should be labeled and brought to the front so that they are not beneath the topographic contours. Surface water bodies wide enough to be shown as more than lines on the scale of the figure should also be filled in for better legibility.
7. Figure 3.2-6 does not appear to incorporate bedrock contours for the more recent wells installed (GW-401D and GW-414 cluster to the southeast and GW-413BR and GW-415BR to the north), given that the contours either end or no data appear to be available. In addition, the 60-foot elevation contour appears to stop short just south of MB-3. Note that the contours from Figure 3.2-2 in the FRI (MACTEC, 2007), which pre-date well installations in these areas, are nearly identical in these areas.
8. Figure 3.2-7 depicts interpreted fracture traces and only includes fracture traces in the MBW based on the Smith, 1997 seismic data.
    a. Please revisit the seismic data collected after 1997 to determine if fracture traces may be identified.
    b. Figure 3.2-1 in the FRI (MACTEC, 2007) depicts additional fault contacts not shown on Figure 3.2-7. Please provide an evaluation of these fracture traces and if relevant, add to Figure 3.2-7. If not, please explain why this data was not used.
9. If possible, please provide an updated 3-dimensional bedrock topography figure with DAPL pools based on Figure 3.2-4 of the FRI (MACTEC, 2007).
10. The text for the structural data in Figure 3.4-1 is illegible. Please increase the size of the boxes shown and add lines to indicate which box is associated with which borehole.

11. Figure 2.4-1 should include structural information for boreholes from previous geophysical logging (in Smith, 1997 and Geomega, 2001).
12. Figure 4.4-1c: Please incorporate the results from residential wells into the extent of NDMA impacts in bedrock groundwater (purple dashed line).
13. Figure 4.4.2-1b: The square symbol for wells screened in DAPL is missing.
14. Figure 4.4.1-1c: Please add a legend and map entry for the estimated extent of diffuse material in bedrock (similar to that for overburden figures).
15. Figure 4.4.6-x: Please renumber either the figures or the text for the metals after aluminum so that they are in the same order. The text currently has the following order: cadmium/ cobalt/nickel, chromium, iron, manganese, arsenic. The figures are in the following order: arsenic, cadmium, chromium, cobalt, iron, manganese, nickel. It is very difficult to compare concentrations as they are grouped in the text.
16. Figure 5.1-1 should also include port/monitoring well screen depths for all of the locations on the cross-sections, not just those that are associated with DAPL or diffuse groundwater

2.10 Appendices

1. Appendix D: Please add borehole geophysics results from previous reports (Smith, 1997 and Geomega, 2001) so that the reader does not need to attempt to locate these data elsewhere. The RI should be a standalone document to the extent feasible.
2. Appendix E, bedrock groundwater results, does not repeat the top row or the left column, requiring the reader to scroll back through several pages to identify which analyte is associated with a result. In addition, the page breaks split columns of results and qualifiers. Please fix the page breaks so that this table (which starts on page 1,835 of 2,089 pages for this appendix) is legible.
3. Appendix E: Please add field parameters (can be separate tables) to this appendix or to a separate appendix. Note that specific conductivity is a critical parameter because it is frequently used to define whether a particular sample is representative of DAPL or diffuse groundwater, and has only rarely been included on the list of laboratory analyses.
4. Appendix F: Olin used the maximum metals value available for instances where both total and dissolved metals results were available for a single sample. However, it would be helpful to evaluate outliers in terms of potential sample turbidity, which can skew metals concentrations.
5. Appendix H: All input values should be tabulated in the report, including vertical gradient, which is not listed at all in the report.

6. Appendix H: overburden horizontal hydraulic conductivity used in the model is lower than the values typically seen from the Site, which ranges from 0.6 to 1272 feet/day. A more appropriate hydraulic conductivity would be 160 feet/day, which is the average overburden hydraulic conductivity. A corresponding vertical hydraulic conductivity would be 16 feet/day. Note that materials with extremely high hydraulic conductivities can be difficult to accurately evaluate using single-well tests, so a true representative hydraulic conductivity may be higher than this. The higher hydraulic conductivity would allow for a higher input recharge. While the Main Street DAPL pool is partially over an industrial area, vegetated areas are located to the west, north, and south of the DAPL pool, increasing potential recharge.
7. Appendix H: While this is fundamentally a bedrock model, the sensitive target of contamination is overburden groundwater. With DAPL pool removal, the contamination in bedrock appears to be limited to approximately 200 feet downgradient.
8. Appendix H: Given the expansion of the contamination in bedrock downgradient, it would be useful to extend the model space further downgradient from the DAPL pool.
9. Appendix H: Please annotate the figures to show the bedrock surface.
10. Appendix H: While the figures showing the different concentrations in the bedrock under separate scenarios are useful, a more extensive sensitivity analysis should also be conducted to include the reasonably expected maximum and minimum values for each input parameter. The output concentration of interest to stakeholders would be the maximum concentration in *overburden* at a selected location downgradient of the DAPL pool.

3.0 REFERENCES

AMEC Foster Wheeler, 2015a. Final Data Gap Analysis and Additional Field Studies Work Plan – Operable Unit 3, Olin Chemical Superfund Site, Wilmington, Massachusetts. July 3.

AMEC Foster Wheeler, 2015b. Final Remedial Investigation Report, Operable Unit 1 & Operable Unit 2, Olin Chemical Superfund Site, Wilmington, Massachusetts. July 24.

GEI, 2004. Part 2 Construction-Related Release Abatement Measure Status Report No. 8, Olin Wilmington Property, 51 Eames Street; Wilmington, Massachusetts. September 7.

Geomega, 2001. The Main Street Bedrock Saddle Investigations, Olin Wilmington Technical Series 17. December.

MACTEC, 2007. Draft Focused Remedial Investigation Report, Olin Chemical Superfund Site, 51 Eames Street, Wilmington, Massachusetts. October.

MACTEC, 2008. Final Interim Response Steps Work Plan, Olin Chemical Superfund Site, 51 Eames Street, Wilmington, Massachusetts. August 8.

MACTEC, 2009. Final Remedial Investigation/Feasibility Study Work Plan, Volume 1. Olin Chemical Superfund Site, 51 Eames Street, Wilmington, Massachusetts. August 14.

MassDEP, 2010. Groundwater Use and Value Determination, Olin Chemical Corporation Superfund Site. September.

Smith, 1997. Supplemental Phase II Report, Olin Corporation, Wilmington, Massachusetts. MassDEP RTN: 3-0471. Smith Technology Corporation, PTI Environmental Services, ABB Environmental Services, Inc., and Geomega. June.